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(54) Power assist system for vehicle.

(57) A power assist system for a vehicle for additionally imparting a driving force of a drive motor to an operation cable operating a clutch mechanism of a vehicle, is arranged in association with the operation cable and comprises an outer casing, a rotor disposed inside the casing, a motor having a drive shaft to which the rotor is mounted to be rotatable, and a reel member around which the operation cable is wound up. The reel member is disposed inside the casing to be in slidable contact to the rotor. When an operation force is applied to the operation cable, the rotor and the reel member are engaged with each other in friction to impart a driving force of the motor to the operation cable as power assist amount. The reel member has a splittable structure into a plurality of reel pieces one of which is provided with a cable guide for the operation cable. The rotor is mounted to the drive shaft to be relatively rotatable by a predetermined stroke of the operation cable. The operation cable is operatively connected to a clutch priming operation member to which an ON-OFF switch is operatively connected, the ON-OFF switch being adapted to control starting and stopping of the driving of the motor in a manner such that, during an operation stroke of the clutch priming operation member, the ON-OFF switch is made ON in an idle period of the operation cable and is made OFF at a maximum operation stroke thereof.

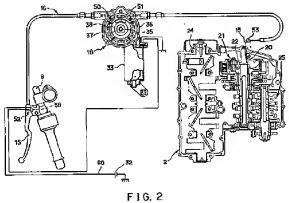

FIG. 2

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BACKGROUND OF THE INVENTION

The present invention relates to a power assist system for a vehicle for operating a clutch mechanism through an operation cable and is particularly concerned with a power assist system for a vehicle clutch capable of preferably saving an operating force of a clutch lever or a clutch pedal.

A motor cycle and an automobil are each provided with a clutch mechanism for intermitting a driving force of an engine on a driving system including a transmission mechanism at the time of starting and speed changing operation. The clutch mechanism is subjected to a clutching operation by having a clutch operating force transferred through an operation cable by manual operation of a clutch lever or footing operation of a clutch pedal. In such a case, a leverage is applied to the clutch lever or the clutch pedal and an operation feelding is moderated by increasing the leverage.

Moreover, the motor cycle and the automobile have a hydraulic power clutch for effecting an intermittent operation of the clutch mechanism in a light feeling of operation. In the power clutch, an intermittent operation of the clutch mechanism is carried out by utilizing a negative pressure such as suction or the like of an oil pump or an oil pressure generated on the oil pump, thus the operating force of the clutch lever or the clutch pedal being moderted.

A conventional hydraulic power clutch is not applicable to a clutch mechanism employing an operation cable, to which a clutch operating force is transferred through the operation cable, and it is difficult, moreover, to provide the hydraulic power clutch additionally as mentioned, a multiplicity of associated parts must be refabricated and much time and labor are hence required, which may lead to a cost increasing.

Further, in the case of such clutch mechanism employing the operation cable, the operating force of the clutch lever or the clutch pedal is moderated by incresing the leverage. However, the clutch operating force cannot be decreased sharply. Particularly, in a motor cycle, a speed change operation must be done so often when travelling on a mountain path with many byways or jamming, and hence, the clutch lever must be manipulated in each case. However, in case the clutch lever is manupilated frequently, the clutch operating force cannot be moderated sufficiently only by the leverage. Therefore, a feeling of operation is made worse and a heavy burden is not avoidable on the manual operation, thus spoiling a comfortable driving condition.

SUMMARY OF THE INVENTION

An object of the present invention is to substantially eliminate defects or drawbacks encountered in the prior art described above and to provide a power assist system for a vehicle capable of realizing an improvement of an operating efficiency of a clutch lever or a clutch pedal of the vehicle and securing a clutching operation of a clutch mechanism in a light feeling to an operator.

Another object of the present invention is to provide a power assist system for a vehicle clutch functioning to add a motor driving force to an operation cable by a clutch operation assisting device as a power assist amount, moderate an operating force of the clutch lever or the clutch pedal and also to secure a sharp clutching operation.

A further object of the present invention is to provide a power assist system for a vehicle capable of providing a power clutch simply and easily to a conventional model of a motor cycle or automobile additionally.

A still further object of the present invention is to provide a power assist system for a vechicle capable of ensuring a steady clutching operation even at a time of motor trouble.

These and other objects can be achieved according to the present invention by providing a power assist system for a vehicle for additionally imparting a driving force of a drive means to an operation cable operating a clutch mechanism of a vehicle, the power assist system being arranged in association with the operation cable and comprising:

an outer casing;

a rotating body disposed inside the casing;

a drive means having a drive shaft to which the rotating body is mounted to be rotatable; and

a winding means around which the operation cable is wound up, the winding means being disposed inside the casing to be capable of being in slidable contact to the rotating body,

wherein when an operation force is applied to the operation cable, the rotating body and the winding means are engaged with each other in friction to impart a driving force of the drive means to the operation cable as power assist amount.

In preferred embodiments, the winding means comprises a reel member which is splittable into a plurality of reel pieces one of which is provided with a cable guide for the operation cable. The reel member is composed of four reel pieces having substantially the same arcuate configuration and disposed in a circumferential direction of the rotating body. The cable guide is composed of engaging holes formed to the reel piece, one of the holes being adapted for a drive side operation cable and

another one of the holes being adapted for a driven side operation cable.

The rotating body is composed of a rotor which is mounted to the drive shaft of the drive means through a hub. The rotor is mounted to the drive shaft to be relatively rotatable by a predetermined stroke of the operation cable.

The power assist system further comprises a speed reduction mechanism for transferring an output power of the drive means to the drive shaft.

The operation cable is operatively connected to a clutch priming operation member to which an ON-OFF switch means is operatively connected, the ON-OFF switch means being adapted to control starting and stopping of the driving of the drive means in a manner such that, during an operation stroke of the clutch priming operation member, the ON-OFF switch means is made ON in an idle period of the operation cable and is made OFF at a maximum operation stroke thereof.

In the case of the motor cycle, the clutch priming operation member is a clutch lever of the motor cycle to which the operation cable is connected and the ON-OFF switch means is provided for the clutch lever.

In the case of the automobile, the clutch priming operation member is a clutch pedal to which the operation cable is connected and the ON-OFF switch means is disposed in association with the clutch pedal.

According to the power assist system of the present invention of the characters described above, the clutch operation assisting device is provided halfway of an operation cable for operating the clutch mechanism and a motor driving force is added to the operation cable by the clutch operation assisting device as a power assist amount, thereby the operating force of the operation cable necessary for the operation of the clutch mechanism being relieved. The operating efficiency of the clutch lever or the clutch pedal is enhanced accordingly, thus ensuring the comfatable driving in the fight feeling of the operation to the operator. Additionally, the power assist system is capable of adding a motor driving force selectively to the operation cable by the clutch operation assisting device as a power assist amount , thus the clutch working rate being designed apprecably large and the sharp clutching operation thus being fairly realized.

Further, the power assist system for a vehecle clutch may be constructed by providing the clutch operation assisting device halfway of the operation cable, and accordingly, the associated parts of the conventional model can be used just as they are, and the power assist system can simply and easily be installed to the conventional model additionally.

Still further, even in the unlikely event that a motor of the clutch operation assisting device runs into trouble, the operating force of the clutch lever or the clutch pedal is securely transferred to the clutch mechanism through operation cable and reel, whereby the clutching operation will never be spoiled by the motor trouble.

The further nature and features of the present invention will be made more clear hereunder through descriptions with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is a side view showing a brief outer appearance of a motor cycle to which the present invention is applicable;

Fig. 2 is a view, partially in section, representing one embodiment of a power assist system for a vehicle relating to the present invention;

Fig. 3 is a plan view showing an arrangement of an operation cable, in an enlarged scale, of the power assisst system shown in Fig. 2;

Fig. 4 is a sectional view of a clutch operation assisting device incorporated in the power assist system of Fig. 2;

Fig. 5 is a schematic side view of the clutch operation assisting device shown in Fig. 4 with a case cover removed;

Fig. 6 is a view, partially in section, showing arrangment of the clutch operation assisting device and the operation cable;

Fig. 7 is an enlarged view showing a clutch lever of the motor cycle;

Fig. 8 is a view showing, from a lower side, a lever holder for mounting the clutch lever of Fig. 7;

Fig. 9 is a sectional view taken along the line IX-IX of Fig. 8, showing a structure of an ON-OFF switch mounted on the lever holder of Fig. 8; and

Fig. 10 is a perspective view representing a case where the power assist system of the present invention is applied to an automobile.

DESCRIPTION OF THE PREFERRED EMBODIMENT

One embodiment of the power assist system for a vehicle clutch relating to the present invention will be described hereunder with reference to the accompanying drawings.

Fig. 1 is a general side view showing a motor cycle to which the present invention is applicable and Fig. 2 is an illustration in development showing a power assist system for a vehicle clutch.

Referring to Figs. 1 and 2, the motor cycle has an engine 2 mounted at a central lower portion of a body frame 1 and a fuel tank 3 is provided above the engine 2. A seat 4 is positioned rearward of the fuel tank 3 on a seat rail 5 of the body frame 1.

A steering mechanism 7 is mounted rotatably on a head pipe 6 of the body frame 1 and a handle 8 is mounted on an upper bracket 7a of the steering mechanism 7. A front wheel 10 is provided on a lower end of a front fork 9 extending downward of the steering mechanism 7.

On the other hand, a swing arm 11 is supported swingably in the form of cantilever at the central lower portion of the body frame 1 and a rear wheel 12 is mounted on a rear end of the swing arm 11.

Meanwhile, a clutch lever 15 functioning as a priming, i.e. operation starting, clutch operating member and a brake lever, not shown, are mounted to bilateral handle parts of the handle 8 mounted on the upper bracket 7a of the steering mechanism 7. An operation cable 16 extends, as shown in Fig. 2, from the clutch lever 15 as a clutch cable, and a clutch operation assisting device 18 is disposed halfway of the operation cable 16. Another end side of the operation cable 16 is coupled to a clutch release lever 19.

The clutch release lever 19 is interlocked with a clutch mechanism 21 through a mechanical operating force transfer mechanism 20 such as pinion-rack mechanism or the like, subjecting the clutch mechanism 21 to the clutching operation against a force of a spring 22. A rotation driving force transferred from a crankshaft 24 of the engine 2 is intermitted to the driving system including a transmission mechanism 25 by a clutching operation of the clutch mechanism 21, which functions to transfer the rotation driving force from the engine 2 to the transmission mechanism 25 on the basis of the force of the spring 22 at an ordinary time.

The operation cable 16 from the clutch lever 15 is drawn round along the body frame 1 through a cable guide 31, as shown in Fig. 3, along with a starter cable 28, a throttle cable 29 and a wire harness 30 and is connected to the clutch release lever 19.

As shown in Fig. 2, the clutch operation assisting device 18 disposed halfway of the operation cable 16 is provided with a motor 33 which is driven by a battery 32. An output power of the motor 33 is transferred to an outer shaft 35, as shown in Fig. 4, through a speed reduction mechanism 34. A hub 37 enclosed within a body casing 36 is mounted on the output shaft 35 to rotate integrally therewith through a taper or spline coupling. The hub 37 is fixed to the motor output shaft 35 to construct one portion of the motor output shaft. The speed reduction mechanism 34 mounted on the motor 33 is then mounted on the body casing 36 and fixed thereto. In this connection, reference numeral 41 denotes a case cover 41 to which a bearing 42 is mounted, and the hub is guided for rotation by the bearing 42.

On the other hand, a rotor 38 in the form of sleeve constituting a rotating body is fitted in a boss portion 37a of the hub 37. An engaging pin 39 projecting axially is planted to the rotor 38 and the engaging pin 39 is engaged as shown in Fig. 5, with an arcuate elongated holes, i.e. slots, 40 formed in an outside flange 37b of the hub 37. The rotor 38 turns relatively by an amount corresponding to the stroke of the hole 40 with reference to the hub 37.

A reel 44 is provided slidably on an outer periphery of the rotor 38. The reel 44 has a split or splittable structure, while forming two cable guide paths 45 and 46 on the outer peripheral side thereof, to comprise arraying a plurality of, or fore, for example, circular split reel pieces 44a, 44b, 44c and 44d in the circumferential direction thereof. The split reel piece may be arranged in two at least.

Engaging holes 47 and 48 are formed in one split reel piece 44a, for example, to be spaced apart in the circumferential direction so as to cross the cable guide paths 45 and 46 respectively, one engaging hole 47 being engaged as shown in Fig. 6, with an end piece 50 of a clutch cable 16a on a drive side of the operation cable 16, while the other engaging hole 48 being engaged with an end piece 51 of a clutch cable 16b on a driven side thereof. The clutch cables 16a and 16b on the drive and driven sides are wound on the reel 44 by half round at least and thus wound thereon substantially one round or more as a whole.

Further, end pieces 52 and 53 are also provided on other end sides of the drive side clutch cable 16a and the driven side clutch cable 16b of the operation cable 16, respectively, the end piece 52 of the drive side clutch cable 16a is engaged with an engaging hole 55 of the clutch lever 15, and the end piece 53 of the driven side clutch cable 16b is engaged with an engaging hole of the clutch release lever 19 and then coupled.

The clutch lever 15 is mounted on a lever holder 56 rotatably, as shown in Figs. 2 and 7, round a rotation center A thereof. The lever holder 56 is fixed to the handle 8 and an ON-OFF switch 58 such as microswitch or the like is mounted near the rotation center A of the lever holder 56.

As shown in Fig. 8, and Fig. 9, the ON-OFF switch 58 is provided with a fixed contact 59a on a side of the lever holder 56 and a movable contact 59b on a side of the clutch lever 15 and carries out an ON-OFF action by turning the clutch lever 15. The ON-OFF switch 58 is set to an OFF state, as

shown in Fig. 7, when the clutch lever 15 is not operated and is also set to be ON in an idle section of the operation cable 16 during an operation stroke of the clutch lever 15 and to be OFF at the point in time of a maximum stroke.

According to an ON-OFF action of the ON-OFF switch 58, a power circuit 60 carries out an ON-OFF operation as shown in Fig. 2 to thereby start or stop the operation of the motor 33.

On the contrary, when the operation cable 16 is drawn by a manual operation of the clutch lever 15, the reel 44 of the clutch operation assisting device 18 is pushed against the rotor 38 to a frictional engagement according to a tensile force of the operation cable 16, and the reel 44 is then compressed onto the rotor 38 to rotate integrally with the rotor 38. Thus, a driving force of the motor 33 is applied to the operation cable 16 through the reel 44 as a power assist. Accordingly, since such force as is required only for pressing the reel 44 against the rotor side to cause a frictional engagement, the clutch lever 15 may be operated very lightly.

Further, when the clutch operation assisting device 18 is actuated by the operation of the clutch lever 15, the motor driving force is added to the operation cable 16 together with a lever operating force to actuate the clutch release lever 19. Therefore, a clutch operation force large enough to work is obtainable and a sharp operation of the clutch mechanism 21 may be ensured. In addition, the clutch mechanism 21 operates for effectively performing the clutching function, thus preventing a rotation output of the engine 2 from being transferred to the transmission mechanism 25.

When the clutch lever 15 is operated by hand to draw the operation cable by a maximum stroke, the ON-OFF switch 58 is turned off and the motor 33 is shut down. Thus, the rotor 38 of the clutch operation assisting device 18 and the reel 44 are prevented from sliding relatively more than necessary as kept in a friction contact.

Still further, when the clutch lever 15 is released, a force of the clutch spring 22 of the clutch mechanism 21 works on the clutch lever 15 through the operation cable 16, thus returning the clutch lever 15 to an original position side. In this case, the hub 37 and the rotor 38 of the clutch operation assisting device 18 are retained in a state ready for accepting an operating force of the operation cable 16 to work thereon. Concretely, the engaging pin 39 of the rotor 38 and the engaging hole 40 of the hub 37 mate with each other at a position indicated by a full line of Fig. 6, and an operating force of the clutch lever 15 is ready for transferring toward the clutch mechanism 21.

Under keeping the engaging relationship between the motor output shaft side and the hub 37 and the rotor 38 in relation to the position of the engaging pin as shown in Fig. 6, in the unlikely event that the motor 33 gets faulty, the operating force transferred to the operation cable 16 is transferred directly to the clutch release lever 19 through the reel 44 by a manual operation of the clutch lever 15, thus realizing the clutching operation of the clutch mechanism 21.

The preferred embodiment of the present invention has been described with reference to the case where the power assist system is applied to a motor cycle, but it can be applied to a motor tricycle and a four-wheel car likewise.

Fig. 10 represents a case where the power assist system for a vehicle clutch is applied to an automobile. One end of an operation cable 63 is coupled to a clutch pedal 62 functioning as a priming, i.e. operation starting, clutch operating member of the automobile and the other end of the operation cable 63 is coupled to a clutch release lever 64. The clutch release lever 64 is coupled to a clutch mechanism 66 through a mechanical operating force transfer mechanism 65 such as a worm mechanism of the like, subjecting the clutch mechanism 66 to the clutching operation.

A clutch operation assisting device 68 having a motor 67 is provided halfway of the operation cable 63 and the motor 67 of the clutch operation assisting device 68 is also started up and shut down by an ON-OFF switch, disposed in association with the clutch pedal, subjected to an ON-OFF action by coming into gear with the clutch pedal 62.

The clutch operation assisting device 68 is not different from the clutch operation assisting device 18 for a motor cycle shown in Figs. 2 to 8, therefore, a further description being omitted herein.

In this connection, while the ON-OFF switch 58 is provided to interlock with the clutch lever 15 in the embodiment, the ON-OFF switch 58 may be provided to interlock with the operation cable.

It is to be noted that the present invention is not limited to the described embodiments and many other modifications and changes may be made without departing from the scope of the appended claims.

Claims

1. A power assist system for a vehicle for additionally imparting a driving force of a drive means to an operation cable operating a clutch mechanism of a vehicle, said power assist system being arranged in association with the operation cable and comprising:

   an outer casing;

   a rotating body disposed inside the casing;

   a drive means having a drive shaft to which the rotating body is mounted to be rotat-

able; and

a winding means around which the operation cable is wound up, said winding means being disposed inside the casing to be capable of being in slidable contact to the rotating body,

wherein when an operation force is applied to the operation cable, the rotating body and the winding means are engaged with each other in friction to impart a driving force of the drive means to the operation cable as power assist amount.

2. A power assist system according to claim 1, wherein the winding means comprises a reel member which is splittable into a plurality of reel pieces one of which is provided with a cable guide for the operation cable.

3. A power assist system according to claim 2, wherein the reel member is composed of four reel pieces having substantially the same arcuate configuration and disposed in a circumferential direction of the rotating body.

4. A power assist system according to claim 2, wherein the cable guide is composed of engaging holes formed to the reel piece, one of the holes being adapted for a drive side operation cable and another one of the holes being adapted for a driven side operation cable.

5. A power assist system according to claim 1, wherein said rotating body is composed of a rotor which is mounted to the drive shaft of the drive means through a hub.

6. A power assist system according to claim 5, wherein said rotor is mounted to the drive shaft to be relatively rotatable by a predetermined stroke of the operation cable.

7. A power assist system according to claim 1, further comprising a speed reduction mechanism for transferring an output power of the drive means to the drive shaft.

8. A power assist system according to claim 1, wherein the operation cable is operatively connected to a clutch priming operation member to which an ON-OFF switch means is operatively connected, said ON-OFF switch means being adapted to control starting and stopping of the driving of said drive means in a manner such that, during an operation stroke of the clutch priming operation member, the ON-OFF switch means is made ON in an idle period of the operation cable and is made OFF at a maximum operation stroke thereof.

9. A power assist system according to claim 8, wherein the vehicle is a motor cycle and the clutch priming operation member is a clutch lever of the motor cycle to which the operation cable is connected and said ON-OFF switch means is provided for the clutch lever.

10. A power assist system according to claim 8, wherein the vehicle is an automobile and the clutch priming operation member is a clutch pedal to which the operation cable is connected and said ON-OFF switch means is disposed in association with the clutch pedal.

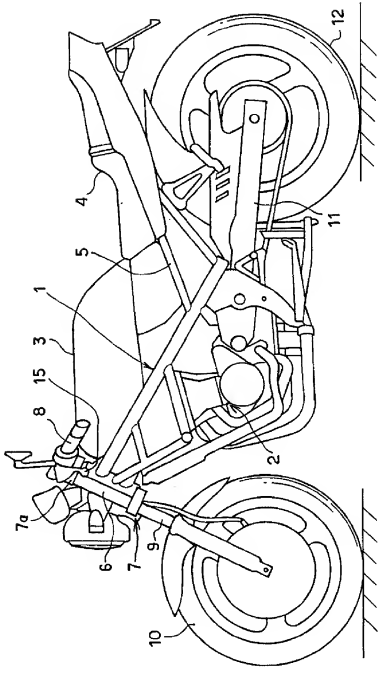

FIG. 1

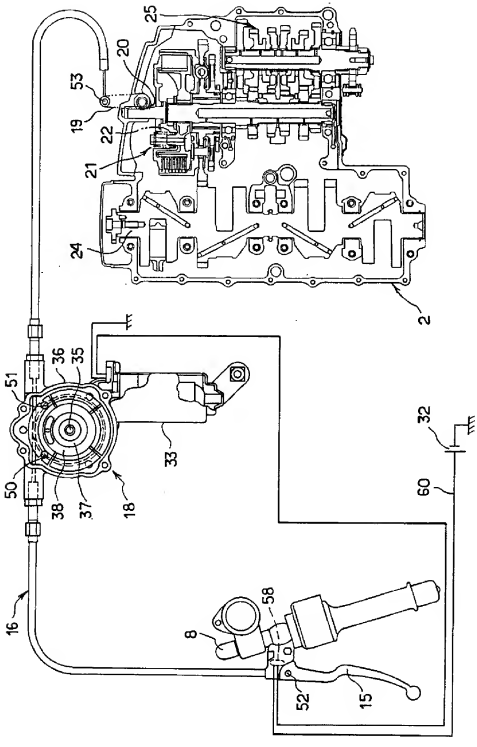

FIG. 2

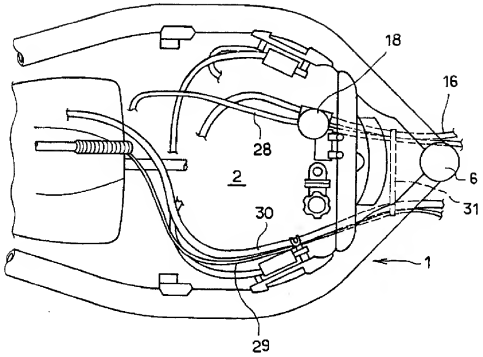

FIG. 3

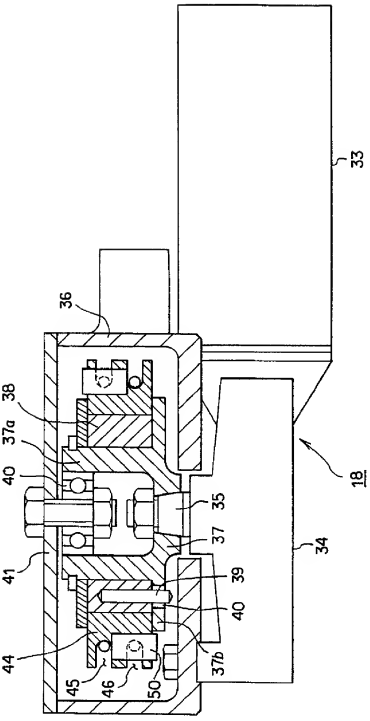

FIG. 4

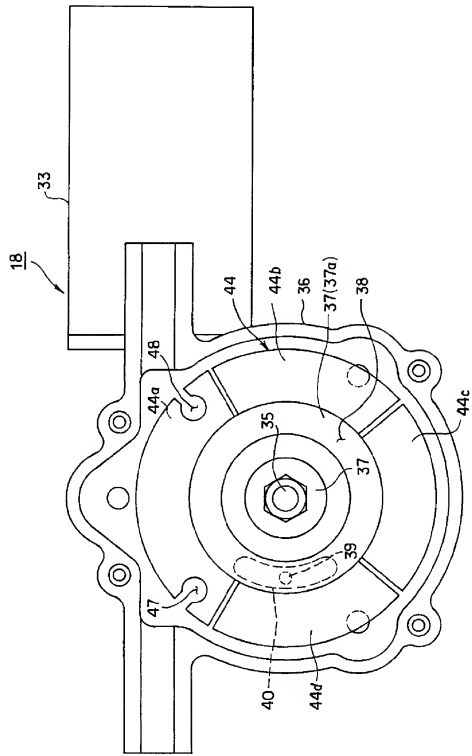

FIG. 5

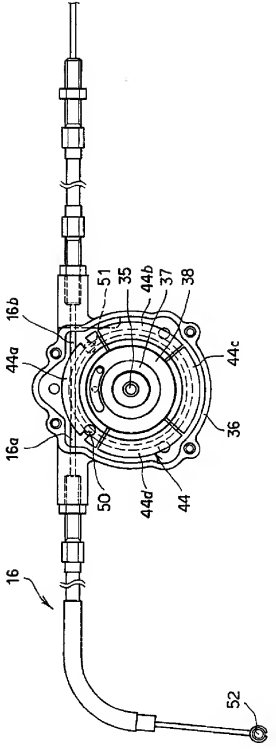

FIG. 6

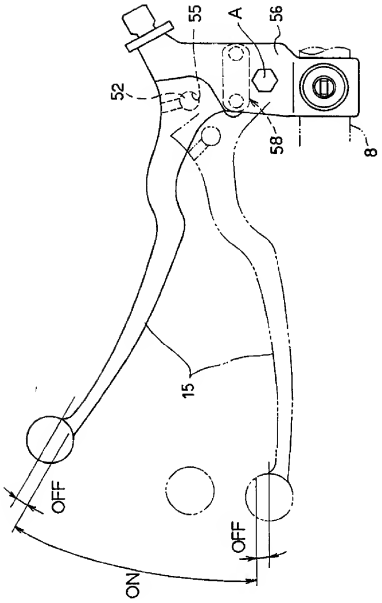

FIG. 7

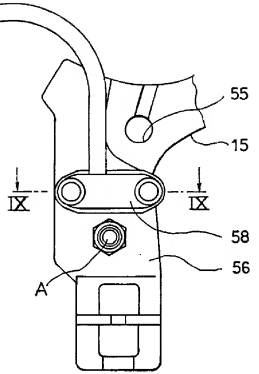

FIG. 8

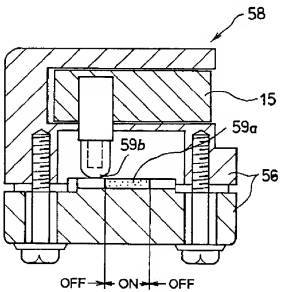

FIG. 9

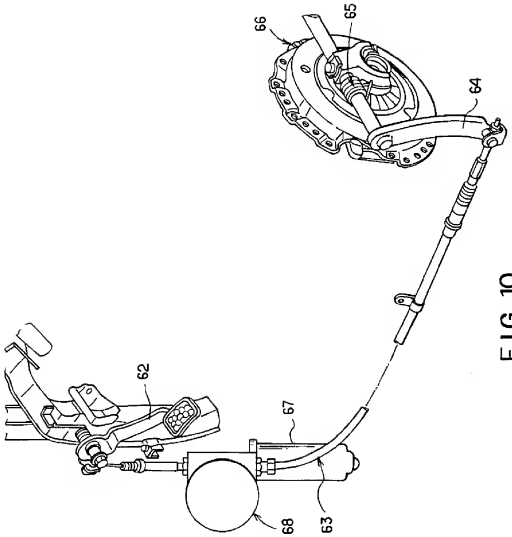

FIG. 10